



## Internal hernias in pregnant women with history of gastric bypass surgery: Case series and review of literature

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### ABSTRACT

**INTRODUCTION:** Gastric bypass surgery is the most common obesity surgery procedure in women. Decreased weight loss favors fertility and leads to pregnancy sometimes just months after surgery, raising the risk of developing gastric bypass-related complications during pregnancy, including the formation of internal hernias.

**PRESENTATION OF CASE:** The first patient presented at 37 weeks of gestation with abdominal pain, nausea and vomiting. X-ray revealed multiple air-fluid levels and absence of gas in colon. She underwent a cesarean section and exploratory laparotomy without complications. A Petersen's space internal hernia was found. The second patient presented at 25 weeks of gestation with abdominal pain and nausea. X-ray revealed multiple air-fluid levels and a "U-shaped" intestinal loop. She underwent exploratory laparotomy with reduction of an internal hernia also in Petersen's space.

**DISCUSSION:** Pregnant patients with internal hernias after gastric bypass are usually of young age and with a several-day history of abdominal pain. Surgical exploration is safe and should not be delayed. The literature review showed that maternal death (9%) and fetal death (13.6%) rates are considerably high.

**CONCLUSION:** The possibility of an internal hernia should always be considered in pregnant women with history of gastric bypass who present with abdominal pain, in order to prevent catastrophic outcomes such as maternal and/or fetal death.

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## 1. Introduction

More than 200,000 bariatric surgery procedures were performed in the United States in 2007 alone, the majority of them accounting for Roux-en-Y gastric bypass.<sup>1</sup> Approximately 80% of patients currently undergoing this procedure are females, many of them of childbearing age.<sup>1,2</sup> Although the benefits of weight loss in these patients have been documented, complications such as the formation of an internal hernia should be highly suspected when patients present with abdominal pain and a history of bariatric surgery. This complication has even led to maternal and/or fetal death in some reported cases.<sup>3–6</sup>

We present the cases of 2 female patients with a history of bariatric surgery that presented with internal hernias during their pregnancies. We also conducted a literature review on presentation, management and outcomes of these patients. A descriptive statistical analysis was also performed.

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## 2. Presentation of cases

### 2.1. Patient 1

A 29-year-old woman (gravida 1, para 0) presented at 37 weeks' gestation with a 6-h history of acute abdominal pain, nausea and vomiting. She had undergone laparoscopic Roux-en-Y gastric bypass 2 years earlier. Initial evaluation revealed severe abdominal pain in right hypochondriac region. Her vital signs and laboratory results were within normal limits. Analgesics and antispasmodics provided rapid relief of her symptoms.

Approximately 4 h later, the abdominal pain re-appeared, and the emergency physician requested an abdominal X-ray. Imaging showed multiple air-fluid levels and absence of gas in colon. Both the attending obstetrician and bariatric surgeon were consulted. The decision was made to make an abdominal C-section and laparotomy.

First, a cesarean section was performed using a midline skin-incision technique followed by a Kerr's uterine segmental incision. A 37-week live product was delivered with an Apgar score of 9/9 after 1 and 5 min respectively. Next, the skin midline incision was extended cephalad and during the exploratory laparotomy an internal hernia in Petersen's space was found. There was yet no evidence of bowel infarction or necrosis, so the hernia was gently reduced and the defect was closed using non-absorbable (2–0 silk)

**Table 1**  
Review of previously reported internal hernias during pregnancy after gastric bypass surgery.

Study	Year	Patient age (year)	Gestation weeks	Interval from bypass: bypass type	Presenting symptoms; duration (days)	Surgical intervention	Finding: hernia location	Fetal outcome	Maternal outcome
Moore et al.	2004	41	31	1.5 years; NR	Abdominal pain; nausea; vomiting	Laparotomy	IH; Mesenteric defect	Death	Death
Charles et al.	2005	22	25	6 months; laparotomy	Abdominal pain; nausea; vomiting	Laparotomy	IH; Petersen's space	Survived	Survived
Baker et al.	2005	33	25	10 months; laparoscopic	Abdominal pain, nausea, vomiting	Laparoscopy + laparotomy	IH; Petersen's space	Survived	Survived
Kakarla et al.	2005	33	12	2.5 years; laparotomy	Abdominal pain	Laparoscopy	IH; Petersen's space	Survived	Survived
		35	36	9 months; laparoscopic	Abdominal pain, nausea, vomiting	Laparotomy + C section	H; Mesenteric defect	Survived	Survived
Loar et al.	2005	31	26 <sup>6/7</sup>	NR; laparoscopic	Abdominal pain	Laparotomy	Midgut volvulus	Survived	Death
Ahmed et al.	2006	26	30	8 months; laparoscopic	Abdominal pain, nausea, vomiting	Laparoscopy	IH; Transverse mesocolon	Survived	Survived
Bellanger et al.	2006	27	33	2 years; laparoscopic	Abdominal pain	Laparotomy	IH; Jejunojunostomy	Survived	Survived
Wang et al.	2007	32	37	11 months; laparotomy	Abdominal pain, nausea, vomiting	Laparotomy	IH; Jejunojunostomy	Survived	Survived
Efthimiou et al.	2009	26	24	9 years; laparotomy	Abdominal pain, nausea, vomiting	Laparotomy	IH; Petersen's space	Death	Survived
Torres-Villalobos et al.	2009	25	32	17 months; laparoscopic; antecolic	Abdominal pain	Laparotomy	IH; Petersen's space	Survived	Survived
		27	30	2.3 years; laparoscopic; antecolic	Abdominal pain	Laparotomy	IH; Petersen's space	Survived	Survived
Gazzalle et al.	2009	38	33	2 years; laparoscopic	Uterine contractions, septic	Laparotomy	IH; NR	Survived	Survived
Gagné et al.	2010	28	37	4 years; laparoscopic; retrocolic	Abdominal pain	Laparotomy + C section	IH; Petersen's space	Survived	Survived
		34	30	4 years; laparoscopic; antecolic	Severe Abdominal pain, nausea	Laparoscopy	IH; Petersen's space	Survived	Survived
		25	6	10 months; laparoscopic; retrocolic	Abdominal pain, nausea, vomiting	Laparoscopy	IH; jejunojunostomy	Survived	Survived
		25	13	3.5 years; Laparoscopic; retrocolic	Severe abdominal pain	Laparoscopy	IH; Transverse mesocolon	Survived	Survived
Hooks et al.	2010	38	36 <sup>6/7</sup>	4 years; laparoscopic	Abdominal pain, nausea, vomiting	Laparoscopy + laparotomy	IH; jejunojunostomy	Survived	Survived
Naef et al.	2010	34	35	2 years; laparoscopic; antecolic	Abdominal pain	Laparotomy	IH; jejunojunostomy	Survived	Survived
Kang et al.	2011	37	33	3 years; laparoscopic	Abdominal pain	Laparotomy	IH; jejunojunostomy	Survived	Survived
Current study	2012	29	37	2 years; laparoscopic; antecolic	Abdominal pain, nausea, vomiting	Laparotomy + C section	IH; Petersen's space	Survived	Survived
		38	25	7 years; laparoscopic; antecolic	Abdominal pain, nausea	Laparotomy	IH; Petersen's space	Survived	Survived

simple interrupted sutures. Other potential sites of hernias were also explored but no hernia was found. The procedure was terminated without further complications, and the patient was discharged after 48 h of observation.

## 2.2. Patient 2

A 38-year-old woman (gesta 4, para 0, cesarean section 1, abortion 2) presented at 25<sup>5/7</sup> weeks' gestation with a 48-h history of abdominal pain and nausea. She underwent a laparoscopic Roux-en-Y gastric bypass 7 years before. Vital signs and laboratory results were reported within normal limits. The emergency physician ordered an abdominal X-ray and both the attending obstetrician and bariatric surgeon were consulted.

Imaging revealed multiple air–fluid levels and a “U-shaped” distended loop. Although the X-ray findings were non-specific, the decision was made to perform an exploratory laparotomy. After proper maternal and fetal monitoring, the laparotomy was performed and an internal hernia was found in Petersen's space and reduced. The defect was closed with non-absorbable simple interrupted sutures. The patient was discharged after 48 h and continued her pregnancy without complications.

## 3. Review of literature

A literature search of the MedLine and PubMed databases was conducted using the key words: “internal hernia”, “intestinal obstruction”, “complication”, “pregnancy”, and “gastric bypass”. All papers written up to 2011 were reviewed. The studies that we included were studies involving internal hernias in pregnant women with history of Roux-en-Y gastric bypass surgery. We excluded studies with (1) incomplete individual patient information (studies that lacked 2 or more of the following: patient age, gestational age, interval of time from bypass surgery to current surgery, presenting symptoms, type of surgical intervention, findings of surgical intervention or fetal/maternal outcome) and (2) complications other than internal hernias and intestinal obstruction/strangulation due to internal hernias. Cross-referencing was used to reduce publication bias. The information collected from each study included number of patients, maternal age, gestational age, presenting symptoms, time since bariatric surgery, exploratory surgery findings and maternal and fetal outcome.

A total of 15 papers (16 including the present study) met our inclusion criteria (Table 1). 4 studies did not meet these criteria. The total number of patients was 22. The number of patients in each study ranged from 1 to 4. Key findings are summarized in Table 2. The mean age of patients was 31.2 years with a range of 22–41 and sample standard deviation (s) of 5.2. Median gestational age was 30.5 weeks with a range of 6–37. Median time since bariatric surgery was 2 years. The most common presenting symptoms were abdominal pain in all 22 patients (100%), nausea in 12 patients (54.5%), vomiting in 10 patients (45.5%), and uterine contractions in just 1 case (4.5%). Abdominal pain was described as severe in just 2 patients (9%), and median duration of all symptoms before consulting with a physician was 48 h, with a range of 0.5 h to 6 weeks.

The most common location of the internal hernia was Petersen's space in 10 patients (45.5%). Maternal death occurred in 2 cases (9%) and fetal death in 3 (13.6%).

## 4. Discussion

Laparoscopic Roux-en-Y gastric bypass is the most common bariatric surgical procedure in young women in the United States.<sup>7</sup> Rapid weight loss in obese women has been associated with

**Table 2**

Summary of findings of 22 pregnant patients with internal hernias after gastric bypass surgery (literature review).

Characteristic	Value
Mean age in years	31.2 (s = 5.2)
20–25	3
26–30	7
31–35	7
36–41	5
Median gestational age (weeks)	30.5
Type of bariatric surgery performed <sup>a</sup>	
Laparotomy	4 (19%)
Laparoscopy	17 (81%)
Median time since bariatric surgery (years)	2
Presenting symptoms	
Abdominal pain	22 (100%)
Nausea	12 (54.5%)
Vomiting	10 (45.5%)
Uterine contractions	1 (4.5%)
Median duration of symptoms (h)	48
Exploratory surgery performed	
Laparotomy	12 (54.5%)
Laparoscopy	5 (22.7%)
Laparotomy + C-section	3 (13.6%)
Laparoscopy + laparotomy	2 (9%)
Findings/location <sup>b</sup>	
Internal hernia; Petersen's space	10 (45.5%)
Internal hernia; jejunojejunostomy	6 (27.2%)
Internal hernia; mesocolon defect	2 (9%)
Other	4 (18.1%)
Outcomes	
Maternal death	2 (9%)
Fetal death	3 (13.6%)

s, sample standard deviation.

<sup>a</sup> In one case the type of bariatric surgery was not reported.

<sup>b</sup> In one case the location of the internal hernia was not reported.

improved ovulatory function, fertility and pregnancy.<sup>7</sup> Furthermore, several authors have documented a decreased incidence of macrosomia, maternal hypertension and maternal diabetes after weight loss.<sup>8</sup> Nevertheless, it has been recommended that pregnancy should be delayed 12–18 months post-operatively, mainly to prevent undue fetal development and spontaneous abortion due to maternal malnutrition after gastric bypass surgery.<sup>9,10</sup>

The safety of pregnancy after RYGBP has been documented,<sup>9,11</sup> but women undergoing this procedure are still at risk of internal hernia formation, anastomotic leaks, gastrointestinal bleeding, small intestine obstructions, and others.<sup>12</sup> These complications often present months or years after surgery, and one of the relatively most common and sometimes life-threatening is the formation of an internal hernia.<sup>12</sup>

The incidence of internal hernias after laparoscopic and open RYGBP is 0.2–5% and 1–4.7%, respectively.<sup>13–15</sup> This entity presents most frequently with abdominal pain, a relatively common symptom during pregnancy that still poses a challenge to the physician due to its diverse etiologies. Internal hernias arise when weight loss causes rapid reduction in intraperitoneal fat, enlarging the surgically-created mesenteric defects and causing the loosening of mesenteric sutures.<sup>10,16</sup> Furthermore, increased intra-abdominal pressure during pregnancy (due to the gravid uterus) increases the likelihood of a small intestine loop herniating.

After gastric bypass, internal hernias most commonly arise in the transverse mesocolon defect, Petersen's space and jejunojejunostomy mesenteric defect.<sup>17</sup> They can be complicated with intestinal obstruction, volvulus formation, perforation and others, and obstetricians must be familiar with the possible long-term complications of bariatric surgery in pregnant patients. The initial evaluation of pregnant patients with abdominal pain must include a detailed history, physical examination, laboratory work and image modalities.

Imaging the pregnant patient is often a challenge due to concerns regarding radiation exposure, and yet several authors have claimed that the best imaging modality in these cases is obtained with a computed tomography (CT) scan.<sup>18</sup> The radiation exposure from a CT scan is an obvious concern for patients, but the benefits and risks should be evaluated. Patients should understand that an internal hernia and/or intestinal obstruction can be a catastrophic event if not detected in time. The risks of fetal effects are almost negligible below doses of 50 mGy,<sup>19</sup> and CT examinations of the pelvis and abdomen rarely exceed 25 mGy.<sup>17</sup> The CT scan should furthermore be evaluated by a radiologist experienced in bariatric patients and/or a bariatric surgeon.

Typical findings on CT scan include clustering and crowding of dilated small-intestine loops with congestion.<sup>17</sup> A large herniated loop may displace anatomic structures due to mass effect. In spite of this, internal hernias may not be detected by imaging, and surgical exploration should be considered in the appropriate clinical setting.<sup>6,20</sup>

In our case series, the X-ray image was highly suggestive of internal hernias. Although the literature advocates for the use of a CT-scan, we believe that an X-ray in the appropriate clinical setting may be an alternative in cases where CT-scanners are not readily available. However, we recommend that each case be individualized and the attending physician should make the decision whether or not a CT-scan should be ordered.

The literature review revealed that internal hernias after gastric bypass surgery in pregnant patients occur at a young age, and that most patients wait at least 2 days before consulting with their physician for abdominal pain. We encourage physicians to emphasize to patients the importance of consulting for abdominal pain especially with a history of previous bariatric surgery. Moreover, initial vital signs and laboratory values were reported normal in most cases.

The most common location for hernias was Petersen's space, and although the published series is small, the incidence of both fetal and maternal death in these cases is high (13.6% and 9% respectively). These findings reinforce the urgent need to identify internal hernias earlier and treat them without delay.

In our experience and according to published data, in order to reduce the incidence of internal hernias in pregnant patients we suggest the following: (1) patients should wait at least 18 months before conception after gastric bypass surgery, (2) both mesenteric and Petersen space defects should be promptly sutured, (3) non-absorbable simple interrupted sutures should be used to close mesenteric defects, and (4) jejuno-jejunostomy and gastro-jejunal anastomosis should both be sutured without excessive tension.

## 5. Conclusion

The possibility of an internal hernia should always be considered in pregnant women with history of gastric bypass who present with abdominal pain.

Both obstetricians and bariatric surgeons must work together, and a high index of suspicion is necessary since in most cases vital signs and laboratory values will be reported as normal. These patients should not hesitate to seek medical attention as soon as possible whenever abdominal pain presents.

Patients should be thoroughly evaluated and if still in doubt, surgeons should not hesitate to perform an exploratory operation to avoid a calamitous outcome.

## Conflict of interest

None.

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## Ethical approval

Written informed consent was obtained from the patients (2) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Authors' contributions

Raúl Leal-González: Data collection and writing, attending obstetrician; Rafael De la Garza-Ramos: Data collection, data analysis and writing; Horacio Guajardo: Data collection and writing, attending bariatric surgeon; Fernando Ayala-Aguilera: Data analysis, attending obstetrician; Roberto Rumbaut: Data collection, attending bariatric surgeon.

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